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Impact evaluation of a sexually transmitted disease preventive intervention among female sex workers in Hohhot, China

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SUMMARY

Objectives: The aim of this study was to evaluate the impact of HIV and sexually transmitted disease (STD) prevention interventions among female sex workers (FSWs) in the city of Hohhot in northern China.

Methods: Three serial cross-sectional surveys were conducted in 2006, 2007, and 2008 among FSWs. A questionnaire was administered to the FSWs, and HIV and syphilis tests were performed for all participants. Intervention activities including condom promotion and provision, increased condom availability and accessibility, and voluntary HIV counseling and testing (VCT) were carried out among FSWs.

Results: There were 624 participants in the 2006 survey, 444 in the 2007 survey, and 451 in the 2008 survey. The United Nations General Assembly Special Session (UNGASS) indicators for FSWs increased from 13.9% in 2006 to 37.7% in 2008 ($p < 0.001$). The average rate of consistent condom use with commercial clients in the month preceding the interview increased significantly from 39.8% in 2006 to 59.6% in 2008 ($p < 0.001$). Not a single HIV-positive case was found among the FSWs over these 3 years, and the prevalence of syphilis decreased remarkably from 9.5% in 2006 to 1.3% in 2008. Logistic regression analysis showed that sauna or hair salon work venues, receiving services from intervention programs, and accepting HIV tests were factors associated with consistent condom use.

Conclusions: The findings suggest that consistent condom use and awareness of HIV/AIDS prevention-related knowledge among FSWs have been improved by the intervention. Further prioritized and combined prevention programs aimed at FSWs are needed in order to prevent the HIV/AIDS epidemic spreading in the general population in China.

1. Introduction

Up until 2011, and since the first case of a person infected by HIV was identified in China in 1985, it is estimated that the number of people living with HIV/AIDS (PLHIV) in China is 780 000, including 154 000 AIDS patients.[1] Between 2005 and 2007, the number of new HIV infections estimated to have been contracted by heterosexual contact increased from 10.7% to 37.9% of total HIV cases, while the proportion of HIV transmissions caused by drug use fell from 44.3% to 29.4%.[2,3] A significant proportion of HIV transmissions in 2007 was estimated to have occurred between female sex workers (FSWs) and their clients.[2] The HIV epidemic in China is further complicated by growing evidence of mixing between intravenous drug users and people who have contracted HIV through sexual contact.[4–8] FSWs, as a population at high risk of contracting and transmitting HIV/AIDS, play an important role in the prevention of the spread of AIDS and sexually transmitted diseases (STDs).[9–11]

The transmission of HIV/AIDS and rates of infection of the virus are closely related to human behaviors, and it has been widely proven that persistent health education and the promotion of intervention activities are the most effective counters to HIV transmission around the world.[12–15] Condom use is recommended by governments and researchers as a useful tool to prevent FSWs and their clients from contracting HIV/AIDS and other STDs.[16–19] When Hong and Li reviewed HIV/AIDS behavioral interventions in China,[20] they found that most interventions had been concentrated in the south and southwest of the country, with a lack of study data available from other regions.

The city of Hohhot is the provincial capital of the Inner Mongolia Autonomous Region in northern China. It has a

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Table 1
Socio-demographic characteristics of female sex workers surveyed in 2006–2008 in Hohhot, Inner Mongolia[a]

Variables	2006 ($n=624$), n (%)	2007 ($n=444$), n (%)	2008 ($n=451$), n (%)
Mean age, years	26.9 ± 7.0	25.1 ± 4.9	25.9 ± 5.7
Ethnicity			
Han	521 (83.5)	389 (87.6)	369 (81.8)
Mongolian	56 (9.0)	37 (8.3)	58 (12.9)
Other	47 (7.5)	18 (4.1)	24 (5.3)
Education, years[b]			
Illiterate	9 (1.4)	9 (2.0)	4 (0.9)
≤6	93 (14.9)	40 (9.0)	32 (7.1)
7–9	327 (52.4)	269 (60.6)	239 (53.0)
10–12	170 (27.2)	114 (25.7)	156 (34.6)
>12	25 (4.0)	12 (2.7)	20 (4.4)
Marital status[b]			
Single	249 (39.9)	278 (62.6)	279 (61.9)
Married	202 (32.4)	133 (30.0)	135 (29.9)
Cohabitating	105 (16.8)	16 (3.6)	22 (4.9)
Divorced	68 (10.9)	17 (3.8)	15 (3.3)
Work venue[b]			
Karaoke bar[c]	281 (45.0)	239 (53.8)	189 (41.9)
Sauna	178 (28.5)	85 (19.1)	117 (25.9)
Hair salon[c]	44 (7.1)	37 (8.3)	80 (17.7)
Street	121 (19.4)	83 (18.7)	65 (14.4)
Residency[b]			
Inner Mongolia	303 (48.6)	90 (20.3)	256 (56.8)
Other province	321 (51.4)	354 (79.7)	195 (43.2)

[a] The t-test was used for the comparison of mean age, and the Chi-square test was used for percentage comparisons across the different years.
[b] $p<0.05$.
[c] Karaoke bars also included night clubs, bars, and hotels; hair salons included hair and beauty salons.

population of approximately 2.8 million inhabitants, including many ethnic minorities. Although Hohhot is still considered a low-epidemic area in China (only 14 HIV antibody-positive found among five high-risk populations in the AIDS sentinel surveillance 2009) compared to other big cities (1636 HIV antibody-positive in Kunming and 1190 HIV antibody-positive in Beijing),[8,21] there has been a pronounced upward trend in HIV/AIDS transmission. The number of reported HIV/AIDS cases since 2006 accounts for 88.9% of all cases in the city (unpublished data from the Hohhot Center for Disease Control and Prevention (CDC)). Sexual intercourse has become the main route of HIV/AIDS transmission.

In 2006, an HIV preventive intervention program was initiated in China with the support of The Global Fund to Fight AIDS, Tuberculosis and Malaria; FSWs were targeted in the first instance, as they are considered a high-risk population. To assess and document the impact of this program, we conducted three unlinked, anonymous, cross-sectional, integrated behavioral and laboratory assessments on samples of FSWs. The first assessment was conducted as a baseline survey in 2006, the second approximately a year after the initiation of the project, and the third another year later.

2. Methods

2.1. Study design

The Chinese CDC in conjunction with provincial and local CDC staff of the Inner Mongolia Autonomous Region conducted three serial cross-sectional investigations of FSW sexual behaviors during 2006–2008 in Hohhot. The surveys were conducted in July, September, and October of each of the study years. The FSWs were enrolled by stratified cluster method. A 50% rate of consistent condom use with commercial clients was used to estimate the sample size, with 90% power and an alpha error rate of 5%. After estimating the whole sample size, estimated numbers of FSWs at each work venue were calculated based on their percentages in 2006. Work venues were classified into four separate groups: (1) karaoke bars, night clubs, bars, and hotels, (2) saunas, (3) hair and beauty salons, and (4) street-based. The numbers of eligible participants in the three surveys were 624 in 2006, 444 in 2007, and 451 in 2008. The numbers of FSWs at each work venue are shown in Table 1. For the purposes of this study a FSW was defined as a female aged over 14 years who conducted commercial sex work as a business. The definition excluded those supplying a masturbation-only service, such as massage services in professional massage parlors. Nor did it include those who occasionally accepted commercial sex in their place of work, such as waitresses and bartenders.

After providing informed consent, participants were asked standardized questions about their demographics, HIV/AIDS-related knowledge, and behaviors by trained CDC staff.

2.2. Interventions

The targeted population was all FSWs in Hohhot. The program was focused on three key intervention activities at their work venues: (1) community mobilization and peer-mediated outreach, including condom promotion and provision (the 100% condom use program); (2) increased access to and utilization of sexual health services, expansion of condom accessibility through social marketing, and increased condom availability in non-traditional outlets; and (3) voluntary HIV counseling and testing (VCT). AIDS/HIV-related information, education, and communication (IEC) materials including booklets, pamphlets, and folded leaflets were distributed among FSWs during the program period. The intervention activities were carried out by the Hohhot CDC after the baseline survey and FSWs could participate in these activities at their work venues or at the CDC voluntarily.

2.3. Measurements

The survey collected the following information: (1) socio-demographic characteristics, (2) HIV/AIDS-related knowledge, (3) sexual behaviors, and (4) results of laboratory tests.

Socio-demographic characteristics included: age, gender, ethnicity (Han, Mongolian, or other), birthplace, marital status (single, married, or divorced), educational level (primary school, middle school, high school, or post-secondary education), work venue, and drug use.

The United Nations General Assembly Special Session (UNGASS) indicators[22] were used to evaluate FSWs' knowledge about HIV/AIDS transmission. The statements analyzed were: (1) People can protect themselves from contracting HIV by having sex with only one faithful, uninfected partner; (2) People can protect themselves from contracting HIV by using condoms; (3) A healthy-looking person can have HIV; (4) A person can get HIV from mosquito bites; (5) A person can get HIV from sharing a meal with someone who is infected. The indicators awareness rate was calculated as the percentage of FSWs surveyed who had answered all five questions correctly.

Sexual behavior information gathered included: (1) age at time of first sex; (2) age at which commercial sex work was started; (3) months spent as a sex worker per year; (4) number of commercial clients in the previous day/week; (5) whether a condom was used during the last sexual encounter with a commercial client; (6) rate of condom use with clients in the previous month; (7) whether a condom was used during the last sexual encounter with a regular partner; (8) rate of condom use with the regular partner in the previous month; and (9) reasons for not using a condom during the last sexual encounter.

FSW program exposure included: (1) whether they got a free condom; (2) whether they received peer education; (3) whether they received STD treatment; (4) whether they received IEC materials; (5) whether they underwent VCT; and (6) whether they obtained the result of the test. A FSW who had at least three types of service from the above list was considered as having been exposed to the program.

2.4. Laboratory analysis

A 3–5-ml blood sample was collected from each participant and sent to a laboratory in Hohhot for HIV and syphilis testing. All specimens were collected and processed in accordance with the manual of procedures approved by the Chinese CDC.[23] An enzyme-linked immunosorbent assay (ELISA; Beijing Wantai Biotechnology Pharmaceutical Co., Ltd) was used to screen for HIV antibodies in the serum. Specimens that returned positive results for HIV antibodies were confirmed by two additional ELISA tests and one Western blot test by the staff of the Inner Mongolia Autonomous Region CDC reference laboratory.[23] A rapid plasma reagin test (RPR; Lanzhou Institute of Biological Products Co., Ltd) was used to test for syphilis antibodies. Those that returned a positive result were confirmed by a *Treponema pallidum* particle agglutination assay (TPPA; Lanzhou Institute of Biological Products Co., Ltd) at the Inner Mongolia Autonomous Region CDC reference laboratory. Syphilis cases were identified by a positive TPPA and RPR.

2.5. Statistical analysis

Data were double-entered using EpiData 3.0 software (The EpiData Association, Odense, Denmark). All statistical analyses were performed using SPSS 13.0 (SPSS Inc, Chicago, IL, USA). Frequencies, percentage ratios, *t*-tests, and Chi-square tests were used to analyze the data. Linear by linear association was used to analyze time trends in the UNGASS indicators and STD rates. Multivariate logistic regression was used to estimate adjusted odds ratios (OR) and 95% confidence intervals (CI) for the association between condom use and variables of interest; $p < 0.05$ was considered statistically significant.

2.6. Ethical considerations

This study was approved by the institutional ethics review boards of the National Center for AIDS/STD Control and Prevention, the Chinese CDC, and the Inner Mongolia Autonomous Region CDC. Due to the unlinked and anonymous testing of samples, it was not possible to trace and treat participants who returned positive results for an STD. Those willing to know their HIV status were referred to government testing centers for free HIV testing, and STD case management was provided to all participants. Community mobilization for syphilis testing and treatment was also carried out. FSWs also received a card through which they could follow up their syphilis serology results and treatment.

3. Results

3.1. Socio-demographic characteristics

A total of 1519 FSWs were investigated, and all of them completed the survey questionnaire and laboratory tests between 2006 and 2008. By ethnicity, 84.2% of FSWs were Han; 87.7% of FSWs had graduated from middle school or above. With regard to work venue, 71.7% of them worked in karaoke bars, saunas, bars, and hotels, and 28.3% of them worked at least temporarily on the street. Interestingly, the marital status of FSWs changed significantly. More than 60% of FSWs reported that they were single in 2007 and 2008, a much larger proportion than in other similar studies.[24,25] The percentage of FSWs who were from other provinces was higher in 2007 than in 2006 and 2008 (Table 1).

3.2. Prevalence of HIV/syphilis

Not a single HIV-positive case was found during this period. The prevalence of syphilis decreased significantly across the 3-year survey period, from 9.5% to about 1%. Of a total of 68 positive results for syphilis, 59 were found in 2006, three in 2007, and six in 2008. Additionally, only one drug user was reported, a rate much lower than in other similar studies,[24–26] but equal to national surveillance results in 2004.[27] Compared to those syphilis-negative FSWs, the 68 syphilis-positive FSWs had a lower education level (primary school or under: 30.9% vs. 11.4%; middle school: 50.0% vs. 55.2%; high school or above: 19.1% vs. 34.4%).

3.3. HIV/AIDS-related knowledge awareness

UNGASS indicators were used to evaluate HIV/AIDS-related knowledge awareness among FSWs. During the 3-year period, the UNGASS indicators rate increased remarkably from 13.9% to 37.7% (Table 2). FSWs who worked in karaoke bars and saunas had a higher knowledge level than those who worked in hair and beauty salons or on the street. FSWs who worked in the different venues significantly increased their knowledge awareness, especially those who worked in hair salons (from 4.5% in 2006 to 36.3% in 2008; $p < 0.05$). FSWs who worked on the street had the lowest HIV/AIDS knowledge awareness.

3.4. Sexual behaviors and condom use

Table 3 shows the sexual behavior characteristics of FSWs in 2006–2008. The average age at which FSWs had their first sexual experience was higher among those surveyed in 2008 than those surveyed in 2006 (20.6 vs. 19.9, $p < 0.001$), however the average age at which FSWs started sex work became younger, and the period between first sexual experience and the start of sex

Table 2
Time trends in the UNGASS index for female sex workers in Hohhot, Inner Mongolia in 2006–2008, stratified by work venue[a,b]

Work venue	2006 (n=624) n (%)	2007 (n=444) n (%)	2008 (n=451) n (%)	Chi-square	p-Value
Karaoke	33 (11.7)	104 (43.5)	81 (42.9)	59.6	<0.001
Sauna	42 (23.6)	19 (22.4)	47 (40.2)	8.6	<0.001
Hair salon	2 (4.5)	4 (10.8)	29 (36.3)	18.5	<0.001
Street	10 (8.3)	14 (16.9)	13 (20.0)	5.5	0.019
Total	87 (13.9)	141 (31.8)	170 (37.7)	80.7	<0.001

UNGASS, United Nations General Assembly Special Session.
[a] Time trends were analyzed by the linear by linear association method.
[b] n (%) refers to the number and percentage of respondents who answered all five questions of the UNGASS index correctly.

work became shorter. Compared to the 2006 results, FSWs surveyed in 2008 worked longer hours during each month or year, while the number of commercial clients did not significantly increase.

The mean percentage of condom use with clients during the most recent sex increased from 60.7% in 2006 to 73.2% in 2007 and 86.3% in 2008. Moreover, the mean percentage of consistent condom use with clients in the previous month increased from 39.8% in 2006 to 55.4% in 2007 and 59.6% in 2008 (Table 3). However, condom use rates between FSWs and their regular partners were much lower; in 2007 only 6.5% of FSWs reported using a condom every time with their regular partner, as compared with a 55.4% condom use rate between FSWs and commercial clients.

The main reasons for not using a condom during the last sexual encounter were the following: client refused to use a condom (36.7% in 2006, 64.4% in 2007, 66.1% in 2008), no condom available (25.4% in 2006, 10.2% in 2007, 12.9% in 2008), and prefer not to use a condom (14.1% in 2006, 8.5% in 2007, 1.6% in 2008).

3.5. Consistent condom use and associated risk factors

Factors that influence the likelihood of FSWs consistently using condoms were analyzed. Sauna or hair salon working venue, receiving services from intervention programs, and accepting HIV tests were factors associated with consistent condom use (Table 4). It was found that program exposure, which means that the FSW took part in at least three activities, showed a positive association with the rate of consistent condom use with clients (OR 1.4, 95% CI 1.1–1.8). Work venue was another influencing factor associated with consistent condom use; working in saunas (OR 1.7, 95% CI 1.3–2.3) or hair salons (OR 1.5, 95% CI 1.1–2.1) may help FSWs use condoms, compared to street-based FSWs. HIV testing (OR 1.6, 95% CI 1.2–2.0) also showed a positive effect on consistent condom use. FSWs who paid more attention to HIV prevention were more likely to consistently use a condom with commercial clients.

4. Discussion

This study shows that syphilis prevalence among FSWs in the city of Hohhot declined over time and that HIV-related knowledge awareness and rates of consistent condom use with commercial clients increased significantly between 2006 and 2008.

One of the most interesting results of this study is the profound change that was measured in the socio-demographic structure of the FSW population in Hohhot over time. While only 39.9% of FSWs were single at the beginning of the study, by 2008, 61.9% reported being single, which coincided with a decrease in the mean age of FSWs. Curiously, the percentage of FSWs who came from other provinces was 79.7% in 2007, much higher than in 2006 (51.4%) and 2008 (43.2%). The factors determining the entry of young migrant women into sex work in Hohhot have not been studied extensively and probably reflect a complex mix of socio-economic and political factors. Furthermore, as the majority of FSWs were migrants, the epidemiology of HIV and STDs in this population is also influenced by the complex relationship between migration and the spread of these diseases.[28,29] Further comprehensive studies on this subject are required.

Our results showed a substantial decline in the prevalence of syphilis over the study period,[30] with a prevalence of only 0.7% in 2007. There were no positive HIV cases reported among FSWs across the 3 years of survey. Similar results were found in other studies.[8,27,31] The decline in the prevalence of STDs could be

Table 3
Time trends in sexual behavioral characteristics of female sex workers in Hohhot, Inner Mongolia, 2006–2008

Behavioral characteristics	2006 (n=624)	2007 (n=444)	2008 (n=451)	p-Value
Age at first sex (mean ± SD), years	19.9 ± 2.3	19.8 ± 2.0	20.6 ± 2.2	<0.001[a]
Age started sex work (mean ± SD), years	23.3 ± 4.8	22.0 ± 3.4	22.6 ± 3.7	<0.001[a]
Period from first sex to sex work start (mean ± SD), years	3.4 ± 4.1	2.2 ± 2.5	2.0 ± 2.8	<0.001[a]
Months of sex work per year	5.9 ± 2.8	7.1 ± 2.8	7.5 ± 2.7	<0.001[a]
Days of sex work per month	14.0 ± 5.4	15.8 ± 4.7	15.5 ± 5.0	<0.001[a]
Commercial clients in previous day				
Mean ± SD	1.7 ± 1.2	1.7 ± 0.8	1.7 ± 1.3	0.824[a]
Range (min–max)	0–15	0–5	0–21	
Commercial clients in previous week				
Mean ± SD	6.6 ± 5.4	7.3 ± 5.1	6.6 ± 5.0	0.074[a]
Range (min–max)	0–30	0–52	0–30	
Condom use during last sex with a client (%)	60.7	73.2	86.3	<0.001[b]
Consistent condom use with clients in previous month (%)	39.8	55.4	59.6	<0.001[b]
Condom use during last sex with regular partner (%)	30.1	25.0	39.0	0.227[b]
Consistent condom use with regular partner in previous month (%)	13.3	6.5	18.0	0.538[b]

[a] Tested by analysis of variance.
[b] Tested by linear by linear association.

Table 4
Results of multivariate logistic regression analysis for factors influencing consistent condom use[a]

Variables	OR	95% CI for OR[b]		*p*-Value
		Lower	Upper	
Work venue				
Karaoke (Ref.)	1			0.001
Sauna	1.7	1.3	2.3	<0.001
Hair salon	1.5	1.1	2.1	0.011
Street	1.1	0.7	1.6	0.795
Education, years				
No education (Ref.)	1			0.051
≤6	0.3	0.1	1.0	0.049
7–9	0.9	0.5	1.6	0.672
10–12	1.1	0.6	1.8	0.866
>12	1.3	0.7	2.2	0.435
Program exposure	1.4	1.1	1.8	0.005
Accept HIV test	1.6	1.2	2.0	0.001
Constant	0.3			0.014

OR, odds ratio; 95% CI, 95% confidence interval.
[a] Variables entered into the multivariate model included: age, work venue (karaoke bar, sauna, hair salon, street), marital status (single, married, cohabitating, divorced), residency (Hohhot, Inner Mongolia, other), ethnicity (Han, Mongolian, other), education (no education, ≤6 years, 7–9 years, 10–12 years, >12 years), age at first sex, number of clients in previous week, program exposure, accept HIV test.
[b] Results for the independent variables that showed no significant association with consistent condom use are not shown in the table.

related to an improvement in safe sex practices in commercial sexual encounters.

After 3 years of HIV/AIDS control and prevention, HIV/AIDS-related knowledge awareness of FSWs was increased. Although the UNGASS indicators awareness rate of HIV/AIDS knowledge among FSWs increased significantly from 13.9% to 37.7% across the 3 years of survey, more education and promotion is required to teach FSWs correct and comprehensive HIV/AIDS-related knowledge. This is particularly true among street-based FSWs in Hohhot. Other studies have shown that HIV/AIDS knowledge awareness among FSWs has not increased in a sustainable manner, even under social and community behavioral interventions, due to the migrant nature of FSWs and the number of new FSWs beginning work in the region.[27,32]

Results for mean age at which FSWs first had sex and mean age at which they started sex work are similar to national results,[27,32] and the number of commercial clients seen in a day or a week is roughly equal to that of another five cities.[32] These data suggest that a more open attitude to sexual behavior is becoming more common, not only among young females living in the more economically advanced areas of eastern and southern China, but also among those living in underdeveloped areas and among minority groups.

Changes in condom use with both clients and regular partners among FSWs in Hohhot were observed over the survey period. Even though the mean percentage of women reporting condom use with clients increased over the study period, condom use with regular partners remained very low; 12.7% of the FSWs surveyed consistently use condoms with their regular partners. The inconsistent use of condoms is a significant risk factor for STDs among FSWs. This poses considerable challenges for controlling the spread of STDs in the general population, particularly if the FSWs' regular male partners also have other sexual partners. Such trends can also serve as early warning indicators for HIV transmission, particularly as the 2007 national HIV estimates found that the proportion of new infections transmitted sexually may have overtaken the share of transmissions spread through needle-sharing behaviors. These findings emphasize the need to promote more frequent STD screening and treatment among FSWs, as well as the need for greater outreach to encourage consistent and correct condom use with all sexual partners, including regular partners. These results are consistent with those of other studies of FSWs in China,[11,24,25,28] which suggest that these behaviors are a major reservoir for expanding STDs in China. This issue constitutes a major challenge for prevention programs targeting FSWs.

Influencing factors analyzed by logistic regression indicated that work venue, program exposure, and accepting HIV testing were associated with consistent condom use among FSWs. Those FSWs who work in karaoke bars, saunas, and hair salons were more likely to use a condom with commercial clients than street-based FSWs. The findings of another study showed that the conversion of a hostile environment to a more facilitative and enabling environment for sex work was a contributing factor to improved condom use.[26] Interventions targeted at reducing violence towards FSWs by partners, the police, local thugs, and shopkeepers may help them access services more easily, as would the ability to carry condoms without fear of them being used as evidence of sex work.

Program exposure and accepting HIV testing had a positive effect on consistent condom use among FSWs, suggesting that the implementation of interventions and FSW initiatives for preventive awareness were associated with an increase in consistent condom use. The most commonly used intervention strategy in China is individual-oriented HIV-related knowledge education and behavior skill training.[20] Other studies have carried out interventions based on community mobilization,[26,33] power,[34] social networking,[35–37] and information–motivation and behavioral skills.[38] Because heterosexual sex is becoming the major HIV transmission route in China, effective measurements and interventions are urgently needed to prevent the spread of HIV/AIDS from the high-risk population to the general population.

This study has several limitations. Firstly, sexual behavior is a sensitive topic, and sexual behaviors placing oneself and others at risk of HIV infection are not socially accepted in China. Therefore, because data were collected by a questionnaire, it is possible that some study participants provided socially desirable responses rather than reporting extramarital sexual behaviors. Participants may also have under-reported commercial sex and other risk behaviors. Secondly, although a large sample of FSWs was surveyed, the fact that only one site was studied may limit the generalization of the findings. Results should not be extrapolated to represent all FSWs in China due to important regional differences in terms of demographics and economic conditions. Thirdly, there was no control group selected in any of the three surveys. In our study, because of ethical considerations and the high fluidity of the FSW population, there was no control group and all FSWs were identified for intervention. Therefore, the dynamics of migrants and demographic changes (from older subjects to younger, more educated ones) might have influenced the improvement in syphilis prevalence, condom use, and awareness of HIV/AIDS knowledge. Fourthly, the three surveys were three unlinked cross-sectional investigations. Because FSWs belong to a dynamic population and did not want to be recognized, it was very difficult for us to carry out follow-up visits among the FSWs during the 3 years. Finally, because of the cross-sectional nature of the data, most responses were evaluated retrospectively and recall bias was therefore unavoidable.

In conclusion, the data presented here suggest that the prevalence of syphilis decreased and that consistent condom use and awareness of HIV/AIDS prevention-related knowledge among FSWs improved in Hohhot after 3 years of intervention. Further prioritized and combined prevention programs aimed at FSWs are needed in order to prevent the HIV/AIDS epidemic spreading in the general population in China. This community-led prevention program should feature community mobilization and

empowerment through peer-led outreach, along with efforts to create a safer environment, increased access to and utilization of health services, the launch of social networks for FSWs, and information–motivation behavioral skills.

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